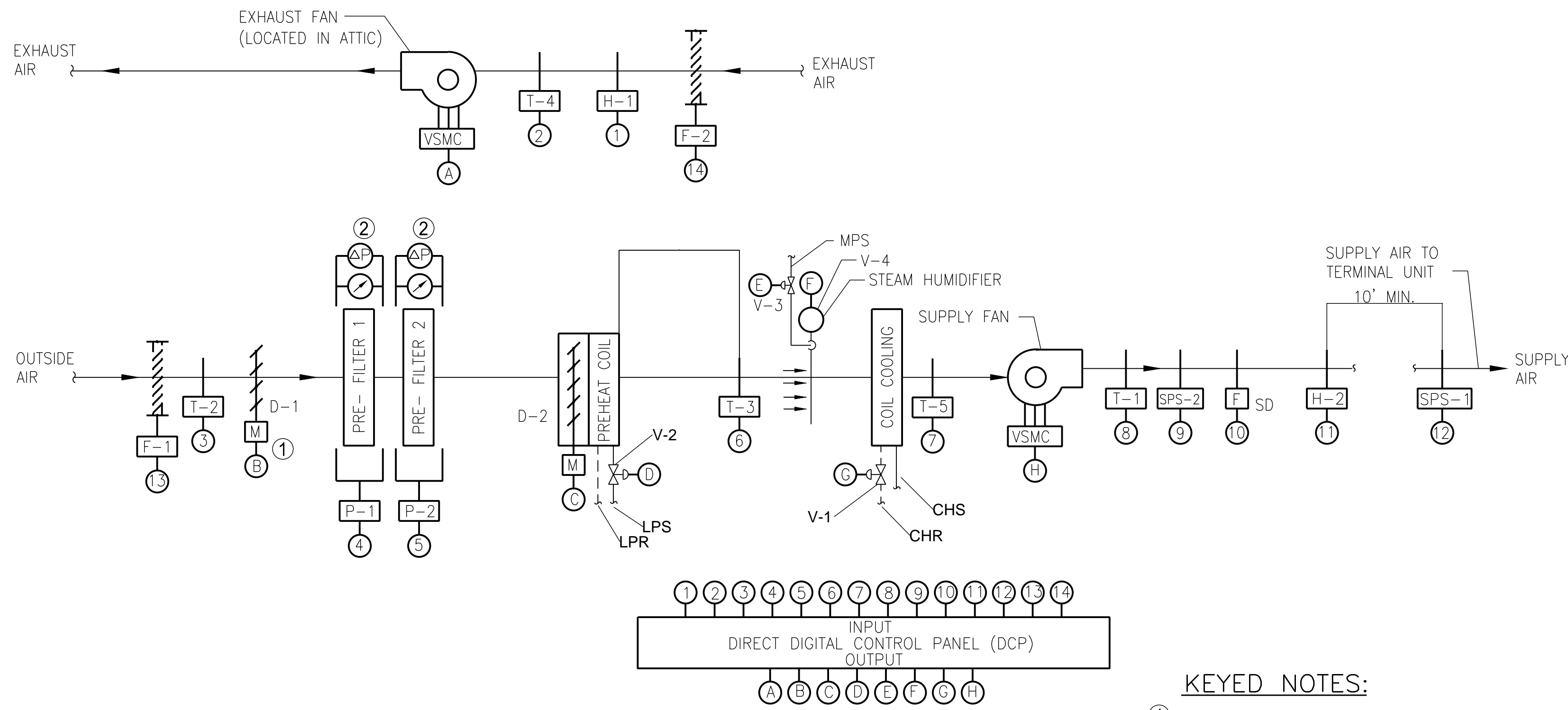


CONTROLS LEGEND		
AFM	AIR FLOW MEASURING DEVICE	MONITORS AIR FLOW RATE TRANSMITS VELOCITY PRESSURE TO DCP.
ΔP	DIFFERENTIAL PRESSURE SENSOR	TRANSMITS DIFFERENTIAL PRESSURE TO DCP TO INDICATE FILTER CONDITIONS AND STATUS OF FANS.
DCP	DISTRIBUTED CONTROL PANEL	CONTROLS OPERATION OF AIR HANDLING UNITS IN ACCORDANCE WITH THE SEQUENCE OF OPERATION.
D-1	OUTSIDE AIR DAMPER, MODULATING	OPENS TO MINIMUM POSITION WHEN SUPPLY FAN STARTS AND CLOSES WHEN SUPPLY FAN STOPS, MODULATES IN ACCORDANCE WITH THE SEQUENCE OF OPERATION
D-2	INTEGRAL FACE AND BYPASS DAMPER, MODULATING	DAMPER MODULATES TO MAINTAIN DESIRED TEMPERATURE IN ACCORDANCE WITH SEQUENCE OF OPERATION.
ECC	ENGINEERING CONTROL CENTER	WORK STATION FOR MONITORING OF SYSTEMS OPERATIONS, CONNECTED TO ECC.
F SD	DUCT SMOKE DETECTORS (FURNISHED AND WIRED TO FIRE ALARM PANEL BY ELECTRICAL)	PROVIDE SMOKE SIGNAL TO DCP.
	PRESSURE GAUGE	FILTER CONDITION INDICATOR (LOCAL)
H-1	EXHAUST AIR HUMIDITY SENSOR	SENSES AND TRANSMITS RETURN AIR HUMIDITY TO DCP FOR CONTROL AND INDICATION.
H-2	SUPPLY AIR HUMIDITY SENSOR	SENSES AND TRANSMITS SUPPLY AIR HUMIDITY TO DCP FOR CONTROL AND INDICATION.
P-1	DIFFERENTIAL PRESSURE SWITCH	SENSES AND TRANSMITS DIFFERENTIAL PRESSURE ACROSS FILTER TO ECC.
P-2	DIFFERENTIAL PRESSURE SWITCH	SENSES AND TRANSMITS DIFFERENTIAL PRESSURE ACROSS FILTER TO ECC.
F-1	AIRFLOW MEASURING STATION	SENSES AND TRANSMITS OUTSIDE AIRFLOW TO ECC.
F-2	AIRFLOW MEASURING STATION	SENSES AND TRANSMITS EXHAUST AIRFLOW TO ECC.

SPS-1	STATIC PRESSURE SENSOR	SENSES AND TRANSMITS DUCT STATIC PRESSURE TO DCP.
SPS-2	HIGH LIMIT STATIC PRESSURE SENSOR	SENSES AND TRANSMITS DUCT STATIC PRESSURE NEAR AHU TO DCP.
T-1	SUPPLY AIR TEMPERATURE SENSOR	SENSES AND TRANSMITS SUPPLY AIR DRY BULB TEMPERATURE TO DCP FOR CONTROL AND INDICATION.
T-2	OUTSIDE AIR TEMPERATURE SENSOR	SENSES AND TRANSMITS OUTSIDE AIR DRY BULB TEMPERATURE TO DCP FOR CONTROL AND INDICATION.
T-3	LEAVING PREHEAT COIL AIR TEMPERATURE SENSOR (FREEZE PROTECTION)	SENSES AND TRANSMITS PREHEAT AIR DRY BULB TEMPERATURE TO DCP FOR CONTROL AND INDICATION.
T-4	EXHAUST AIR TEMPERATURE SENSOR	SENSES AND TRANSMITS RETURN AIR DRY BULB TEMPERATURE TO DCP FOR INDICATION ONLY.
T-5	LEAVING COOLING COIL AIR TEMPERATURE SENSOR	SENSES AND TRANSMIT COOLING COIL DRY BULB TEMPERATURE TO DCP FOR INDICATION ONLY.
V-1	CHILLED WATER CONTROL VALVE, 2-WAY MODULATING TYPE	VARIABLES CHILLED WATER FLOW TO COOLING COIL IN RESPONSE TO DCP.
V-2	STEAM CONTROL VALVE, 2-POSITION	ON-OFF STEAM FLOW TO PRE-HEAT COIL IN RESPONSE TO DCP.
V-3	STEAM CONTROL VALVE, 2-POSITION	ON-OFF STEAM FLOW TO HUMIDIFIER
V-4	STEAM CONTROL VALVE, 2-WAY MODULATING	VARIABLES STEAM FLOW TO HUMIDIFIER IN RESPONSE TO DCP.
VSMC	VARIABLE SPEED MOTOR CONTROLLER WITH MOTOR STARTER	CONTROLS SUPPLY AND EXHAUST FANS MOTOR SPEED IN RESPONSE TO DCP.



1 AC-1 CONTROL DIAGRAM (VAV WITH ECONOMIZER)  
SCALE: NONE

SYSTEM POINT LIST													
SYSTEM POINT DESCRIPTION	POINT TYPE							ALARMS					DIAGNOSTICS
	GRAPHIC	TRENDING	ANALOG INPUT	DIGITAL INPUT	ANALOG OUTPUT	DIGITAL OUTPUT	SOFTWARE POINT	HIGH ANALOG	LOW ANALOG	BINARY	SENSOR FAIL	COMM. FAIL	
VAV 100% OUTDOOR AIR AC WITH HYDRONIC COOLING, STEAM PREHEAT, AND EXHAUST FAN													
SUPPLY FAN STATUS	X			X									
SUPPLY FAN SPEED	X	X			X								
SUPPLY FAN START/STOP						X							
EXHAUST FAN STATUS	X			X									
EXHAUST FAN SPEED	X	X			X								
EXHAUST FAN START/STOP						X							
OUTSIDE AIR DAMPER POSITION	X	X			X								
PRE-FILTER NO. 1 DIRTY FILTER ALARM	X			X						X			DIRTY FILTER ALARM
PRE-FILTER NO. 2 DIRTY FILTER ALARM	X			X						X			DIRTY FILTER ALARM
EXHAUST AIR TEMPERATURE	X	X	X								X		SENSOR FAILURE - EXHAUST TEMPERATURE
EXHAUST AIR HUMIDITY	X	X	X								X		SENSOR FAILURE - EXHAUST HUMIDITY
EXHAUST AIR HUMIDITY SETPOINT	X						X		20%		X		SENSOR FAILURE - EXHAUST HUMIDITY
OUTSIDE AIR TEMPERATURE	X	X	X								X		SENSOR FAILURE - OUTSIDE AIR TEMPERATURE
OUTSIDE AIR FLOW METER	X	X	X										
EXHAUST AIR FLOW METER	X	X	X										
STEAM PRE-HEAT VALVE POSITION	X	X				X							
INTEGRAL FACE AND BYPASS DAMPER POSITION	X	X			X								
COOLING COIL LOW ENTERING TEMPERATURE	X			X						X			LOW LIMIT ALARM
COOLING COIL VALVE POSITION	X	X			X								
COOLING COIL LEAVING AIR TEMPERATURE	X	X	X										
SUPPLY AIR TEMPERATURE	X	X	X										
SUPPLY AIR TEMPERATURE SETPOINT	X						X						
SUPPLY AIR TERMINAL WITH MOST OPEN DAMPER POSITION	X	X					X						
HUMIDIFIER OPEN/CLOSE VALVE POSITION	X	X				X							
HUMIDIFIER MODULATING VALVE POSITION	X	X	X										
LEAVING AIR HUMIDITY			X								X		SENSOR FAILURE - LEAVING HUMIDITY
HIGH LEAVING AIR HUMIDITY ALARM	X			X						X			HIGH LEAVING AIR HUMIDITY ALARM
HIGH LEAVING AIR HUMIDITY SETPOINT													
DUCT STATIC PRESSURE	X	X	X				X		3"	0.05"		X	SENSOR FAILURE - DUCT STATIC
DUCT STATIC PRESSURE SETPOINT							X						
HIGH STATIC ALARM	X			X						X			HIGH STATIC ALARM
HIGH STATIC ALARM SETPOINT							X						
ECC COMMUNICATION STATE							X					X	ECC COMMUNICATION FAILURE
GENERAL NOTES: PROVIDE BUS CONNECTION FOR VARIABLE SPEED MOTOR CONTROLLER.													

## SEQUENCE OF OPERATION FOR VARIABLE AIR VOLUME AIR HANDLING UNIT WITH ECONOMIZER AC-1

### 1. GENERAL

- UNIT IS NORMALLY STARTED AND STOPPED BY THE DCP OR REMOTELY AT THE ECC. H-0-A SWITCH SHALL BE KEPT IN THE "AUTO" POSITION. "HAND" AND "OFF" POSITIONS SHALL BE USED ONLY FOR MAINTENANCE. WHEN THE UNIT IS "OFF" D-1, AND D-3, SHALL BE FULLY CLOSED. WHEN THE UNIT IS "ON" D-1, D-2 AND D-3 SHALL MODULATE IN ACCORDANCE WITH THE FOLLOWING SEQUENCE:

### 2. TEMPERATURE CONTROL

- SUPPLY AIR TEMPERATURE, SENSED BY T-1, SHALL BE MAINTAINED AT SETPOINT VIA DCP BY MODULATING V-1, V-2, AND D-2 IN SEQUENCE.

### 3. AIR FLOW CONTROL

- OUTSIDE AIR DAMPER SHALL MODULATE TO THE FULLY OPEN POSITION WHILE UNIT IS IN OPERATION.
- THE SUPPLY AIR FLOW SHALL BE CONTROLLED BY THE DCP MODULATING THE SUPPLY FAN VARIABLE SPEED MOTOR CONTROLLER (VSMC) TO MAINTAIN DUCT STATIC PRESSURE, SENSED BY SPS-1.
- THE DUCT STATIC PRESSURE SETPOINT (ADJUSTABLE) WILL BE DETERMINED BY TEST AND BALANCE IN ORDER TO MAINTAIN A FIXED OUTDOOR AIR FLOW, SENSED BY F-1 AND ALSO MUST MAINTAIN A MAXIMUM AIR TERMINAL DAMPER SET POINT OF 95%.
- THE DCP, USING TOTAL SUPPLY AIR AND EXHAUST AIR FLOW SIGNALS, SHALL RESET THE RETURN AIR FAN VSMC TO MAINTAIN A CONSTANT AIR FLOW DIFFERENCE BETWEEN THE SUPPLY AIR AND THE EXHAUST AIR AS DETERMINED BY TEST AND BALANCE IN ORDER TO MAINTAIN +0.05-IN.WG. BUILDING PRESSURE.
- THE DCP, USING HIGH PRESSURE SENSOR SPS-2 LOCATED AT THE SUPPLY FAN DISCHARGE, SHALL PREVENT THE SUPPLY FAN FROM DEVELOPING OVER 3" OF STATIC PRESSURE (FIELD ADJUSTABLE). IF STATIC PRESSURE AT SPS-2 DOES EXCEED 3" THE SUPPLY AIR FAN SHALL STOP.

### 4. HUMIDITY CONTROL

- WHEN THE DCP IS NOT CALLING FOR HUMIDITY, SENSED BY RETURN AIR HUMIDITY H-1, 2-WAY "ON-OFF" CONTROL VALVE V-3 SHALL REMAIN CLOSED. WHEN THE DCP IS CALLING FOR HUMIDITY, V-3 SHALL REMAIN OPEN.
- RETURN AIR HUMIDITY SHALL BE MAINTAINED AT SETPOINT VIA DCP BY MODULATING CONTROL VALVE V-4 TO MAINTAIN THE DESIRED HUMIDITY. THE DCP SHALL OVERRIDE THIS CONTROL TO MAINTAIN HUMIDITY OF 80% AS SENSED BY H-2. DCP SHALL CLOSE VALVE V-3 WHENEVER THE SUPPLY FAN IS OFF. VALVE V-4 SHALL BE INTERLOCKED WITH A TEMPERATURE SWITCH TO KEEP THE HUMIDIFIER OFF UNTIL CONDENSATE TEMPERATURE APPROACHES STEAM TEMPERATURE.
- WHEN THE OUTSIDE AIR TEMPERATURE IS ABOVE 50°F (ADJUSTABLE) AS MEASURED BY T-3, "ON-OFF" CONTROL VALVE V-3 SHALL REMAIN CLOSED.

### 5. PREHEAT STEAM VALVE WITH INTEGRAL FACE AND BYPASS DAMPER:

- IF THE AIR TEMPERATURE AS SENSED BY T-2 FALLS BELOW 45°F, V-2 SHALL BE OPENED FULLY AND D-2 SHALL MODULATE AS REQUIRED TO MAINTAIN THE AIR TEMPERATURE AS SENSED BY T-3 AT 50°F (ADJUSTABLE) WITHIN A RANGE OF +/- 5°F. IF AIR TEMPERATURE AS SENSED BY T-2 IS 45°F OR ABOVE, V-2 SHALL BE CLOSED AND D-2 SHALL MODULATE TO ALLOW FULL BYPASS AIRFLOW.

### 6. COOLING COIL:

- THE COOLING COIL WILL MODULATE TO MAINTAIN THE TEMPERATURE SETPOINT OF 55°F (ADJUSTABLE) AS MEASURED BY T-5. WHEN THE UNIT IS SHUTDOWN, THE COOLING COIL WILL BE COMMANDED TO A PRESET POSITION SHOULD THE OUTDOOR AIR TEMPERATURE FALL BELOW THE LOW OUTDOOR AIR TEMPERATURE SETPOINT. UPON A LOSS OF AIRFLOW, THE COOLING COIL WILL BE OFF. UPON A LOW LIMIT TEMPERATURE TRIP, THE CHILLED WATER VALVES WILL OPEN FULLY TO FLOW THROUGH THE COIL(S).

### 7. FILTERS

- THE FILTER PRESSURE DROP WILL BE MONITORED BY THE DIGITAL CONTROLLER DIGITAL INPUT FROM A DIFFERENTIAL PRESSURE SWITCH. IF THE PRESSURE DROP EXCEEDS THE SET POINT (0.5" WG ADJUSTABLE), AN ALARM WILL BE GENERATED.

### 8. FREEZE PROTECTION

- IF THE AIR TEMPERATURE AS SENSED BY T-3 FALLS BELOW 40°F, AN ALARM SIGNAL SHALL INDICATE AT THE DCP AND ECC. IF THIS TEMPERATURE FALLS BELOW 40°F, THE SUPPLY AND RETURN FANS SHALL SHUT DOWN AND A CRITICAL ALARM SHALL INDICATE AT THE DCP AND ECC.

### 9. AUTOMATIC SHUTDOWN/RESTART

- WHEN SMOKE IS DETECTED BY DUCT SMOKE DETECTOR, F SD, THE SUPPLY AND RETURN FANS SHALL SHUT "OFF" AND AN SUPERVISORY SIGNAL SHALL BE TRANSMITTED TO THE FIRE ALARM SYSTEM.
- EXHAUST FANS SERVING AREA OF THE SUPPLY FAN SHALL CONTINUE TO RUN. SUPPLY AND RETURN FANS SHALL RESTART WHEN FIRE ALARM CIRCUIT IS RESET.

### 10. EMERGENCY CONSTANT SPEED OPERATION

- UPON FAILURE OF THE VSMC, THE SUPPLY AND RETURN FANS SHALL BE STARTED/STOPPED MANUALLY AT THE DCP OR THE ECC THROUGH THE BY-PASS STARTER. FANS SHALL THEN BE OPERATED AT CONSTANT SPEED.



Engineering  
Service

Rev	Date	Design	Drawn	Reviewed	Submitted	File name	Rev date	Rev scale
1								

Rev	Date	Design	Drawn	Reviewed	Submitted	File name	Rev date	Rev scale
1								

Rev	Date	Design	Drawn	Reviewed	Submitted	File name	Rev date	Rev scale
1								

Rev	Date	Design	Drawn	Reviewed	Submitted	File name	Rev date	Rev scale
1								

Rev	Date	Design	Drawn	Reviewed	Submitted	File name	Rev date	Rev scale
1								

Rev	Date	Design	Drawn	Reviewed	Submitted	File name	Rev date	Rev scale
1								